

# **Intel® Xeon™ Processor with 512 KB L2 Cache Overshoot/Undershoot Verification**

## **Version 2.0**

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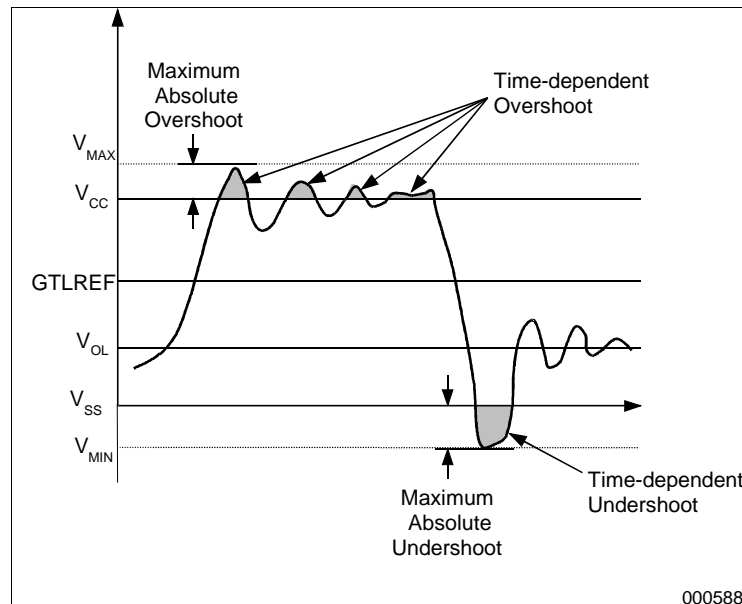
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**Note: This version of the overshoot/undershoot checker utility, *gowsim*, is only valid for system bus designs using the Intel® Xeon™ processor with 512 KB L2 cache. This utility is not valid for use with other processors.**

## Overview

The Intel® Xeon™ processor with 512 KB L2 cache has overshoot/undershoot specifications for system bus signals. These specifications stipulate that a signal at the output of the driver buffer and at the input to the receiver buffer must not exceed a maximum absolute overshoot voltage limit and a minimum absolute undershoot voltage limit assuming a  $V_{CCMAX}$  of 1.5 V. Refer to the latest version of the Intel Xeon processor with 512 KB L2 cache datasheet for additional details regarding overshoot and undershoot specifications. Exceeding these limits will cause damage to the processor. There is also a time dependent, non-linear overshoot requirement above  $V_{CTERM}$  and undershoot requirement below GND that is dependent on the amplitude and duration of the overshoot/undershoot.

The overshoot/undershoot checker utility, *gowsim*, has been developed to check for all three of these requirements. This is a post-processing utility that evaluates an OEM generated ASCII data file, which contains time in the first column, followed by space(s), and node voltage in the second column, at the inputs and outputs of the processor, checking for any violation of the specifications from a simulation or measurement perspective. This utility should be run on the results of all simulations and measurements to verify there are no violations. The *gowsim* utility contains absolute overshoot/undershoot limits that are well in excess of the processor datasheet values referenced in Table 1. This difference exists because the *gowsim* utility considers the specific waveform shape of the overshoot/undershoot event and allows users to input specific activity factors values that may allow for greater overshoot/undershoot. However, Intel recommends designers still target the system bus design to not exceed the  $V_{MAX}/V_{MIN}$  values of 1.80/-0.38V to improve the likelihood that overshoot/undershoot events will pass the *gowsim* checker.



**Figure 1 - System Bus Signal Waveform Exhibiting Overshoot/Undershoot**

**Table 1 - Overshoot/Undershoot Parameters**

Parameter	Description	Specification	Units
V <sub>CC</sub> MAX	Maximum operating voltage for the processor.	1.5	V
V <sub>MAX</sub>	Maximum absolute voltage for system bus signals at the input of the receiver buffers	1.80	V
V <sub>MIN</sub>	Minimum absolute voltage for system bus signals at the input of the receiver buffers	-0.38	V
Overshoot	Time dependent overshoot amount above V <sub>cc</sub>	<sup>1</sup>	
Undershoot	Time dependent undershoot amount below GND	<sup>1</sup>	

<sup>1</sup> These parameters cannot be specified in absolute terms. They can only be verified by running this *gowsim* tool.

## File Contents

The *Intel® Xeon™ Processor with 512 KB L2 Cache Verification* tool consists of several files contained in a directory labeled “ov\_un\_tool” in the *Intel® Xeon™ Processor Signal Integrity Models* zip file. *Gowsim* is available in separate executables for the MS-DOS executable for Windows\* NT\* and Windows\* 2K\* workstations and the following four operating systems:

- IBM\* AIX\* (compiled under version 4.1)
- Hewlett-Packard\* HP-UX\* (compiled under version V.10.20)
- Sun\* Microsystems Solaris\* (compiled under version System 5, Release 4.0)
- Redhat\* Linux\* (compiled under Release 6.2)

The “ov\_un\_tool” directory in the zip file contains the following files:

Filename:  
 readme.pdf (this document)  
 gowsim\_hp  
 gowsim\_ibm  
 gowsim\_nt.exe  
 gowsim\_sun

## Tool Operation

The program used in the verification process solely relies on the Time-Voltage data file that is extracted from the simulation results. The tool expects one full clock cycle of data including a rising and falling transition past the GTLREF threshold voltage in order to evaluate the integrity of the layout.

The ASCII data file format requirements are:

- 1- The two columns should be time, followed by “space(s)”, and followed by voltage.
- 2- No column headers or empty rows.
- 3- Voltage should be in Volts; time units are not important so long as they are consistent (this may sound surprising, but think of it as the time units canceling out).
- 4- The format of the numbers is not important (0.0001 versus 1.000E-4).

The overshoot checker processes the Time-Volt files and returns whether or not the waveforms meet the overshoot/undershoot requirements (see Table 2 for pass/fail messages). The verification process typically takes under a minute for all the files extracted from the simulations.

To execute *gowsim* in a UNIX environment, simply type “./gowsim\_*platform*” (where *platform* is either hp, ibm, or sun) and the input file name, as shown below. For Windows NT or Windows 2K, open a DOS window and type “gowsim\_nt” and the input file name. The program takes as an argument the name(s) of the .wvs file(s):

- Example: `./gowsim_ibm filename.wvs`
- Example: `gowsim_nt filename.wvs`

The program will output one of the five messages listed in Table 2 below.

Message	Description
<b>PASSED</b>	Signal waveform meets overshoot/undershoot requirements
<b>FAILED: ov_un.txt (Time-dependent overshoot/undershoot exceeded)</b>	Signal waveform exceeds the time dependent overshoot above $V_{CTERM}$ /undershoot below GND
<b>UNKNOWN: ov_un.txt (nearly DC waveform rejected)</b>	Waveform did not meet minimum transition requirements

**Table 2 - Gowsim Output Messages and Descriptions**

### Example Run

Copy the “Time-Volt” data file(s), for all the nodes, into one directory and run the overshoot checker utility at once:

Input\_sim\_data.wvs:

```
0.000 0.446
0.010 0.460
0.020 0.479
0.030 0.500
0.040 0.522
0.050 0.546
...
0.660 1.700
0.670 1.800
0.680 1.800
0.690 1.700
0.700 1.607
0.710 1.503
0.720 1.407
...
```

```
> ./gowsim_ibm input_sim_data.wvs
```

The tool prints the evaluation result for each file names on the screen.

### Known Issues

The tool has a maximum input of 50,000 lines.

The tool will not accept redundant values in the time column. Take care in using tools that may truncate significant digits such as spreadsheet programs.

### Failure Analysis

In the case of a waveform failure, examine the waveform to make sure there is no obvious flaw in the simulation resulting in an excessively high-voltage pulse. If there is no flaw in the data, then the only recourse to meet the process guidelines is to attempt to design the system bus with less overshoot above Vcc and/or less undershoot below GND. Excessive overshoot/undershoot failures can be rectified by decreasing the amplitude of the overshoot/undershoot and reducing the duration of the overshoot/undershoot. Since there is an exponential relation between the signal voltage and the overshoot/undershoot requirement, it is normally far more effective to attempt to reduce the overshoot/undershoot voltage rather than the overshoot/undershoot duration.

Also note that the *gowsim* utility applies pass/fail criteria to the worse case waveform contained in the Time-Volt input file and, by default, assumes that the magnitude and duration of the worse case waveform occurs on every clock cycle (activity factor = 1). Activity factor can be adjusted by adding “-act <num>” in the command line for *gowsim*.

➤ Example: `gowsim_nt -act 0.01 filename.wvs`